Tribhuvan University
Institute of Science and Technology
Model Question Paper

Bachelor Level/First Year/ Second Semester/ Science — Full Marks: 80
Computer Science and Information Technology (CSC 152) — Pass Marks: 24
(Discrete Structure) — Time: 3 hours.

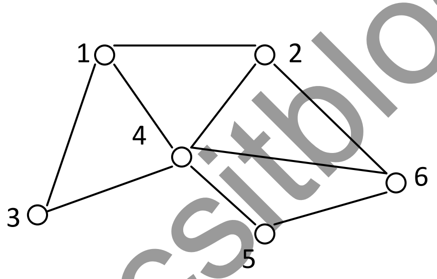
Attempt all questions.

Group A (10x2=20)

1. A restaurant displays the signs “Good food is not cheap”, and competing restaurant displays the signs “Cheap food is not good”. Are the two restaurants saying the same things?
2. Show that $(p \vee q) \wedge [\neg p \wedge \neg q]$ is a contradiction.
3. Given the following grammar, what is the language accepted by this grammar?

$$S \rightarrow xy$$
$$S \rightarrow zA$$
$$S \rightarrow Az$$
$$A \rightarrow y$$

4. Make the regular expressions to identify the identifiers. Mention your assumptions clearly.
5. State the Pigeon Hole principle. Find the minimum number of students in a class to be sure that three of them are born in the same month.
6. A man has six friends. How many ways he may invite one or more of them to a dinner?
7. Suppose that a connected planar simple graph has 20 vertices, each of degree 3. Into how many reasons does a representation of this planar graph split the plane?
8. Is the following graph bipartite? Discuss.



9. Write the expression $\{[(a+b)\times c]\times(d+e)\}-[f-(g\times h)]$ as a tree and then express the result in operator prefix notation.
10. Draw the binary search tree for the following words Ask, Art, Ate, Able, Alto, Also, Avid, Ant.

Group B [5 x 4=20]

11. Differentiate between existential and universal quantifier with suitable examples.

    OR

    Show that it is a valid conclusion from the premises $p \rightarrow q$, $p \rightarrow r$, $r \rightarrow s$, $\neg s$ and $p \vee q$.
12. Define deterministic finite state automata. Construct a DFA whose language is the set of strings that ends with 111 and contains odd number of one’s.

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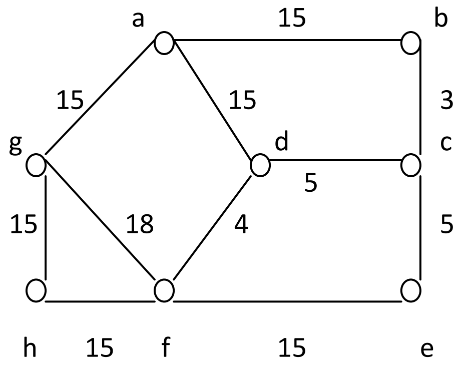
13. Define the binomial coefficient. Write the general term of the binomial expression. Also show that the sum of the binomial coefficients is equal to 2^n.
14. How can you show that two graphs are isomorphic? Discuss invariants that can be used to show that two graphs are not isomorphic with suitable example.
15. Determine a railways network of minimal cost for the cities in figure below and represent the resultant network in spanning tree.



Group C [5x8]

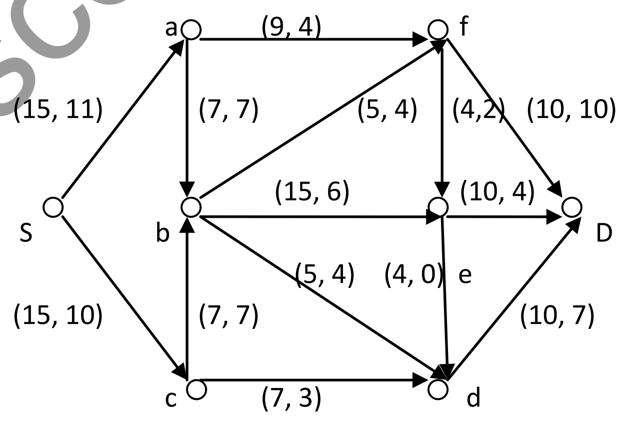
16. Explain tautologies, contradictions and contingencies with suitable example.
17. Verify rules of inferences with suitable examples.

    OR

    State the second principle of mathematical induction. Show that $f_1^2 + f_2^2 + \cdots + f_n^2 = f_n f_{n+1}$, whenever n is a positive integer. Here f_is are i^{th} Fibonacci numbers.
18. What do you mean by difference equation and its boundary condition? Solve $a_{n+2} - 5a_{n+1} - 6a_n = 2$ with initial condition $a_0 = 1$ and $a_1 = -1$.
19. What is shortest path problem? Discuss Dijkstra's algorithm for finding the shortest path in a weighted graph with at least 15 vertices and 20 edges and show each step using Dijkstra's algorithm to find shortest path between any two vertices of your choice.

    OR

    What is Euler's formula for planar graphs? How can Euler's formula for planar graphs be used to show that a simple graph is non-planar.
20. Find maximal flow for the network shown in the figure below.



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